CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD **April 9, 2003**

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED MAINTENANCE DREDGED MATERIAL FROM THE GLACIER NORTHWEST SEATTLE CEMENT TERMINAL, DUWAMISH WATERWAY, SEATTLE, WASHINGTON (Public Notice 92-2-00452) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT THE ELLIOTT BAY DMMP SITE.

1. **Introduction**. The following summary reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington Departments of Ecology and Natural Resources, and the Environmental Protection Agency) on the suitability of up to 10,000 cubic yards (cy) of dredged material from the Glacier Northwest Seattle Cement Terminal, in the Duwamish River at Seattle, Washington (Fig.1). Disposal of suitable material is planned for the Elliott Bay non-dispersive DMMP disposal site. Disposal of material unsuitable for open water disposal is planned for an approved upland site. Project depth of -36 ft. MLLW would be provided along with one foot of allowable overdepth (to –36 ft. MLLW) in the project area. Any exposed surfaces that do not meet Washington State SMS antidegradation standards following dredging will be capped with suitable material.

   This determination of suitability for open-water disposal is based on the acceptability of the sampling conducted in two events by Glacier Northwest contractors and subcontractors in January and April of 2002 (Table 1). All relevant test data from these sampling events is contained in a report submitted by Pacific International Engineering, dated 2 October 2002. These data were considered sufficient and acceptable for decision-making based on best professional judgment.

Table 1. Regulatory Tracking Dates

SAP received	November 26, 2001
SAP approved	January 4, 2002
Sampling dates	January 15, 2002 April 22-23, 2002
Data report submitted	October 4, 2002
Recency Determination: High Concern (2 years)	April 2004
DAIS Tracking number	GLANW-1-B-F-183

Table 2. Project Synopsis

Time of proposed dredging	June 15, 2003
Proposed disposal sites	Elliott Bay open water non-dispersive site, and at an approved upland location
Sediment ranking	High
Project last dredged	1993

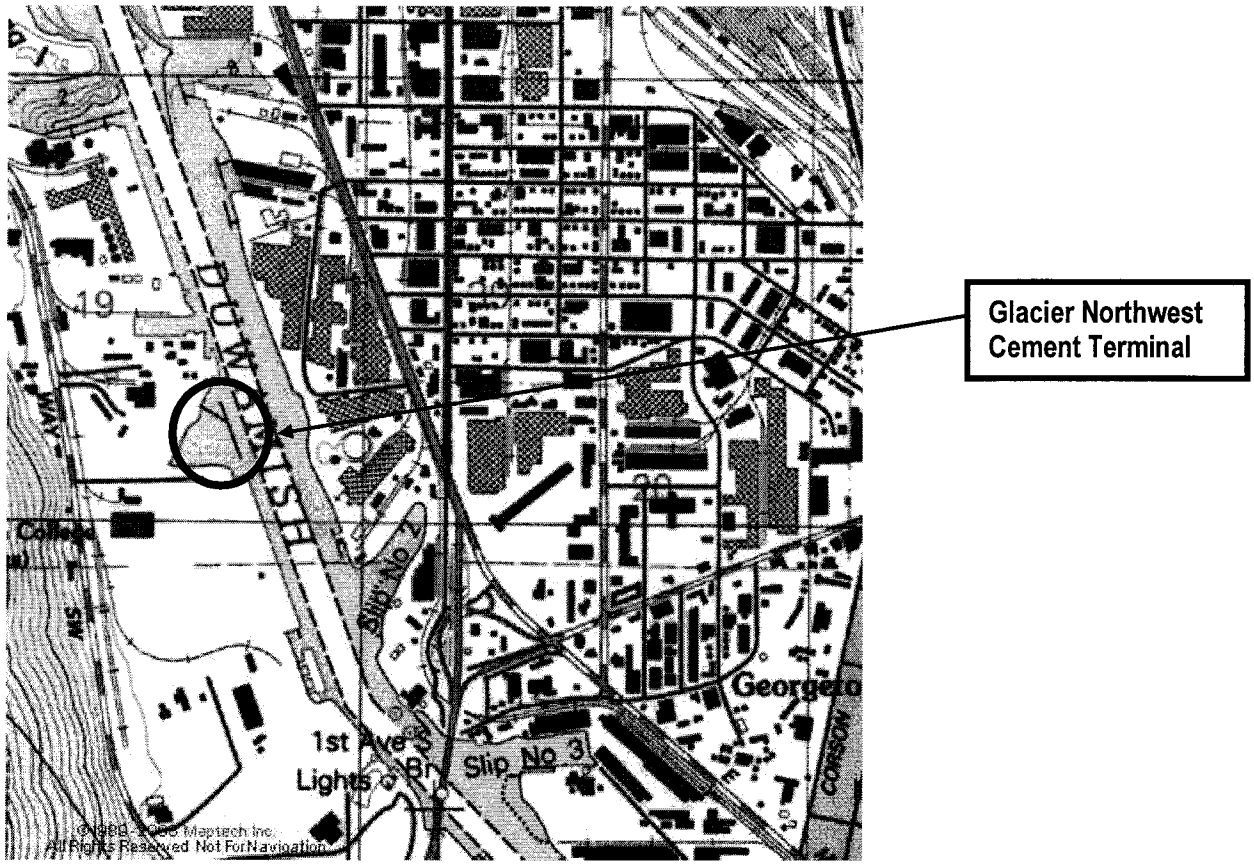

Figure 1. Vicinity Map

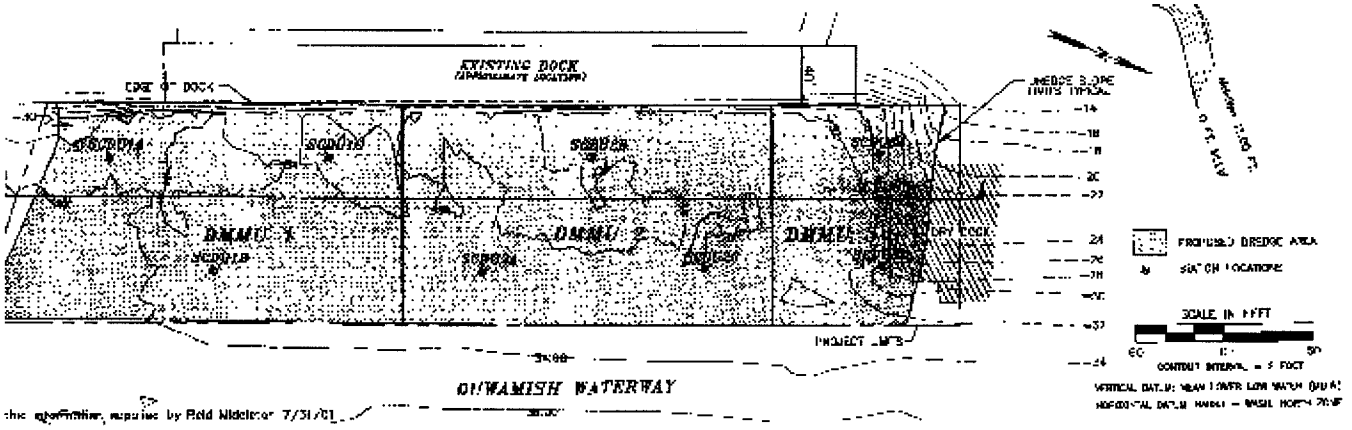

Figure 3 Sample Station Locations January 2002

Figure 2. DMMU sampling scheme.

2. **Initial Sampling.** Sampling took place on 15 January 2002 and the approved SAP was followed. Nine cores were taken, with material from three cores composited for each of three surface DMMUs (Fig. 2). One additional foot of material immediately below the proposed dredge prism was also collected ("Z" sample), which was composited for a representative sample from each DMMU, and archived pending results from the dredge prism analysis (per EPTA 1988, as clarified by Kendall 2001). This level of sampling was in accordance with DMMP guidelines for projects in high-ranked areas. In addition to being high-ranked, the Lower Duwamish area, in which this project is located, is a Superfund site, added to the National Priorities List on 1 December 2000.

3. **Chemical Analysis and QA/QC Issues.** Three composites were analyzed for conventional parameters and DMMP chemicals of concern (Tables 3 and 4.) DMMU 1 and DMMU 2 each had only one detected SL exceedance, for PCBs. DMMU 3 had SL exceedances of arsenic, zinc, DDT, PCBs and TBT. All three DMMUs had non-detected exceedances of 2,4-Dimethylphenol (at 30 ppb; SL = 29 ppb). All three DMMUs subsequently underwent bioassay analyses.

4. **Bioassay Results and QA/QC Issues.** Two rounds of bioassay testing were conducted. Samples from the initial sampling event were submitted to Northwester Aquatic Sciences Lab on Feb. 20, 2002, for the standard suite of three bioassays. The 10-day acute amphipod bioassay used *Eohaustorius estuarius* as the test organism; the 96-hr sediment larval bioassay used *Mytilus galloprovincialus* as the test organism, and the marine polychaete *Neanthes arenaceodentata* was used as the test organism for the 20-day juvenile infaunal growth test.

   Reference sediment was initially collected from Carr Inlet (CARR REF). However, the grain sizes of the reference sediments collected showed approximately 30% difference in fines content from the test sediments, a larger discrepancy than that recommended by the DMMP program. Results of the initial bioassay suggested that the CARR REF sediment did not adequately factor out any grain size effects, particularly for the amphipod bioassay, and that test was rerun. Since holding times for initially collected sediments had expired, new sediments were collected from the initial sampling locations. Reference sediments were collected from a Holmes Harbor (HH 06-A) reference site that more closely matched the fines, and particularly the clay content, of the test sediments for the amphipod bioassay. Control sediments for both rounds of bioassay testing were from Yaquina Bay, Oregon.

   There were no 1-hit failures of the bioassay interpretive criteria. Both DMMU 2 and DMMU 3 had 2-hit responses on the amphipod bioassay, but only DMMU 2 had a corroborating hit (in the *Neanthes* growth test). Thus, DMMU 1 passed DMMP guidelines for open water disposal, but DMMU 2 did not. (see Table 5). Since DMMU 3 exceeded the BT trigger for TBT, it would need to pass bioaccumulation testing as well as bioassays before being found suitable for open-water disposal. Thus, though DMMU 3 passed bioassay testing, it cannot be found suitable for open-water disposal in the absence of bioaccumulation testing. Glacier Northwest opted not to conduct this testing.

   Results of the cadmium chloride reference toxicant test for the amphipod bioassay were inconclusive, and no 96-hr LC50 was reported for this test. Review of laboratory procedures found that solutions for this test were improperly mixed. Although the reference toxicant test was unusable, *Eohaustorius* survival in the control and reference sediment treatments was within performance limits, and there is no reason to believe that the amphipods in this test were unusual. Thus, the agencies have determined that the data from this test is acceptable for decision-making.

All other bioassays met their respective performance guidelines for negative controls, reference sediments and positive controls (see Table 6). All data from the initial *Neanthes* growth and sediment larval tests, and the amphipod retest, were considered useable for regulatory decision-making.

5. **Z-Sample Testing.** Archived composites from the Z-samples (1 foot below proposed dredging prism) of DMMU 2 and DMMU 3 were analyzed for some chemicals of concern for comparison with Washington State antidegradation standards. The evaluation standard for interpreting Z-sample sediment quality data is the Sediment Management Standards Sediment Quality Standard (SQS) (see Table 9).

   The Z-sample for DMMU 1 was not analyzed, as this DMMU passed suitability criteria for open water disposal.

   DMMU 2-Z was analyzed for total PCBs and metals. No PCBs were detected. Arsenic was measured at 64.3 mg/kg, which is above the SQS criterion of 57 mg/kg. The measured mercury concentration of 0.60 mg/kg is above both the SQS and CSL criteria of 0.41 mg/kg and 0.59 mg/kg, respectively.

   Sample DMMU 3-Z was analyzed for TBT (porewater) only. The detected concentration of 3.4 µg/L was well above both the DMMP SL and BT criteria (0.15 µg/L), and above that found in the overlying DMMU (0.71 µg/L).

   Based on the above data, the agencies made the following determination data sufficiency, which was sent to Glacier Northwest in a letter dated 5 November 2002:
   1. Data collected to date for this project are **sufficient** for determining that DMMU #1 is suitable for open water disposal, and ***may*** be dredged without violating state antidegradation regulations and DMMP policies (see WAC 173-204-120, and Kendall 2001).
   2. Data collected to date are **sufficient** for determining that DMMUs #2 and 3 are not suitable for open water disposal, and for determining that these DMMUs ***may not*** be dredged to the original proposed depth without violating state antidegradation regulations and DMMP policies.
   3. Data collected to date are **insufficient** for determining an alternative depth to which dredging may take place without violating state antidegradation regulations and DMMP policies.

6. **Suitability.** This memo documents the suitability of proposed dredged sediments from the Glacier Northwest Cement Terminal in the Duwamish River for open water disposal at a non-dispersive DMMP site. The data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP program, except as noted above. Based on the results of the previously described testing, the DMMP agencies concluded that **3,250 cubic yards, from DMMU 1, are suitable** for open water disposal. Open water disposal may be at the Elliott Bay non-dispersive site. This sediment was not proposed for beneficial uses and was not evaluated for in-water placement other than at a DMMP disposal site.

   A total of **6,670 cubic yards, from DMMU 2 and DMMU 3, are NOT suitable** for open water disposal and must be disposed at an approved upland or confined site. However, DMMUs 2 & 3 may not be dredged until any exposed surface does not violate state anti-degradation standards. A plan to address exposed surface issues could include deeper or shallower dredging, capping, and/or further testing. Such plans should be coordinated carefully with the DMMP agencies.

This memorandum documents the suitability of proposed dredged sediments for disposal at a DMMP open-water disposal site. This determination of suitability does not preclude the consideration of this material for an appropriate beneficial use. It does not constitute final agency approval of the project. During the public comment period, which follows a public notice, the resource agencies will provide input on the overall project. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under section 404(b)(1) of the Clean Water Act. If a Section 404 permit is issued for this project, a dredging plan must be developed and submitted prior to dredging to the Enforcement Section of the Regulatory Branch of the Seattle District Corps of Engineers. This plan must include technology and methodology that is technically adequate to separate suitable from unsuitable or uncharacterized material.

7. References.

EPTA 1988. Evaluation Procedures Technical Appendix. Prepared by the Corps of Engineers in cooperation with the Environmental Protection Agency, Region 10, and the Washington State Departments of Ecology and Natural Resources.

Kendall, D.R. 2001. DMMP Clarification Paper: Clarifications to the DMMP Z-sample analysis guidance and/or post dredge monitoring policy. Prepared by David Kendall (US Army Corps of Engineers) for the DMMP agencies, SMARM 2001.

Table 3. Results of conventional analyses for the GNW Cement Terminal characterization.

	PARAMETER	S1	S2	S3	CARR REF	HH06-A REF
	Volume (cubic yards)	3,250	3,360	3,310	-	-
Grain Size	% Gravel	2.0	0.02	0.3	0.4	0.1
Grain Size	% Sand	12.3	9.3	12.6	37.4	26.4
Grain Size	% Silt	67.8	69.8	65.9	53.0	47.4
Grain Size	% Clay	18.3	21.1	20.4	4.3	27.3
Grain Size	% Fines (clay+silt)	86.1	90.9	86.3	57.3	74.7
	Total Solids, %	51.8	50.9	51.7	56.5	31.1
	Volatile Solids, %	7.16	7.43	7.31	-	-
	Total Organic Carbon, %	2.31	2.34	2.28	-	-
	Total Ammonia, mg/kg	55.4	42.7	47.6	17.1	7.2
	Total Sulfides, mg/kg	1370	2590	2630	213	243

Notes:
CARR REF - reference from Carr Inlet N of Raft Island
HH06-A - from Holmes Harbor

Table 4. Chemical results of the initial sampling (January 15, 2002) for Glacier Northwest Cement Terminal.

Parameter	CAS[a]	DMMP Guidelines			DMMP 1		DMMP 2		DMMP 3	
		SL[b]	BT[c]	ML[d]						
Metals (mg/kg-dry weight; ppm)										
Antimony	7440-36-0	150	150	200	0.4	N	0.67	N	31.1	N
Arsenic	7440-38-2	57	507.1	700	12.2		11		**181**	
Cadmium	7440-43-9	5.1	---	14	0.456		0.432		0.764	
Chromium	7440-47-3	---	---	---	25.8	N	24.0	N	33.30	N
Copper	7440-50-8	390	---	1300	62.9		60.7		233	
Lead	7439-92-1	450	---	1200	38.3		33.2		162	
Mercury	7439-97-6	0.41	1.5	2.3	0.19		0.21		0.37	
Nickel	7440-02-0	140	370	370	23.4		21.8		25.1	
Silver	7440-22-4	6.1	6.1	8.4	0.43		0.418		0.724	
Zinc	7440-66-6	410	---	3800	110	N	101	N	**765**	N
Organometallic Compounds (ug/L)										
Tributyltin (Interstitial Water)	56573-85-4	0.15	0.15	---	0.034		0.028		**0.71**	
Organics (ug/kg dry weight; ppb)										
Total LPAH	---	5200	---	29000	318		425		815	
Acenaphthylene	208-96-8	560	---	1300	35		28		55	
Acenaphthene	83-32-9	500	---	2000	13		73		55	
Anthracene	120-12-7	960	---	13000	89		87		180	
Fluorene	86-73-7	540	---	3600	26		50		64	
Naphthalene	91-20-3	2100	---	2400	15		17		31	
Phenanthrene	85-01-8	1500	---	21000	140		170		430	
2-Methylnaphthalene	91-57-6	670	---	1900	13		13		19	
Total HPAH	---	12000	---	69000	2237		2221		5473	
Benz(a)anthracene	56-55-3	1300	---	5100	190		170		430	
Benzo(a)pyrene	50-32-8	---	3600	3600	210		190		420	
Benzo(b)fluoranthene	205-99-2	---	---	---	370		320		600	D
Benzo(k)fluoranthene	207-08-9	---	---	---	99		100		260	
Total Benzofluoranthenes (b+K)		3200	---	9900	469		420		860	
Benzo(g,h,i)perylene	191-24-2	670	---	3200	140		150		290	
Chrysene	218-01-9	1400	---	21000	280		260		570	D
Dibenz(a,h)anthracene	53-70-3	230	---	1900	38		41		73	
Fluoranthene	206-44-0	1700	4600	30000	380		370		1200	D
Indeno(1,2,3-cd)pyrene	193-39-5	600	---	4400	140		160		330	
Pyrene	129-00-0	2600	---	16000	490		460	D	1300	D
Chlorinated Hydrocarbons										
1,2-Dichlorobenzene	95-50-1	35	37	110	ND	U	ND	U	12	J
1,2,4-Trichlorobenzene	120-82-1	31	---	64	ND	U	ND	U	ND	U
1,3-Dichlorobenzene	541-73-1	170	1241	---	ND	U	ND	U	ND	U
1,4-Dichlorobenzene	106-46-7	110	120	120	ND	U	ND	U	ND	U
Hexachlorobenzene	118-74-1	22	168	230	ND	U	ND	U	ND	U
Phthalates										
Bis(2-ethylhexyl)phthalate	117-81-7	8300	13870	---	460		380		ND	U

Parameter	CAS[a]	DMMP Guidelines			DMMP 1		DMMP 2		DMMP 3	
		SL[b]	BT[c]	ML[d]						
Butyl benzyl phthalate	85-68-7	970	---	---	48		45		94	
Diethyl phthalate	84-66-2	1200	---	---	ND	U	ND	U	ND	U
Dimethyl phthalate	131-11-3	1400	1400	---	17		22		17	
Di-n-butyl phthalate	84-74-2	5100	10220	---	17		17		16	
Di-n-octyl phthalate	117-84-0	6200	---	---	ND	U	ND	U	ND	U
Phenols										
2-Methylphenol	95-48-7	63	---	77	ND	U	ND	U	ND	U
2,4-Dimethylphenol	105-67-9	29	---	210	ND	U	ND	U	ND	U
4 Methylphenol ╪	106-44-5	670	---	3600	5.7	J	ND	U	8.6	J
Pentachlorophenol	87-86-5	400	504	690	10	J	6.5	J	28	J
Phenol	108-95-2	420	876	1200	6.5	J	7.7	J	12	J
Miscellaneous Compounds										
Benzoic Acid	65-85-0	650	---	760	ND	U	ND	U	ND	U
Benzyl Alcohol	100-51-6	57	---	870	11		8.9	J	7.7	J
Dibenzofuran	132-64-9	540	---	1700	14		29		39	
Hexachlorobutadiene	87-68-3	29	212	270	ND	U	ND	U	ND	U
Hexachloroethane	67-72-1	1400	10220	14000	ND	U	ND	U	ND	U
N-Nitrosodiphenylamine	86-30-6	28	130	130	ND	U	ND	U	ND	U
Volatile Organics										
Ethylbenzene	100-41-4	10	27	50	ND	U	ND	U	ND	U
Tetrachloroethene	127-18-4	57	102	210	ND	U	ND	U	ND	U
Trichloroethene	79-01-6	160	1168	1600	ND	U	ND	U	ND	U
Xylene	108-38-3	40	---	160	ND	U	ND	U	ND	U
Pesticides and PCBs										
Aldrin	309-00-2	10	37	---	ND	U	ND	U	ND	U
Chlordane	5103-71-9	10	37	---	ND	Ui	ND	Ui	ND	Ui
4,4'-DDD	72-54-8	---	---	---	0.91	J	0.93	JP	7.3	
4,4'-DDE	72-55-9	---	---	---	ND	Ui	0.79	JP	3.9	P
4,4'-DDT	50-29-3	---	---	---	ND	Ui	ND	Ui	ND	Ui
Total DDT	---	6.9	50	69	0.91		1.72		**11.2**	
Dieldrin	60-57-1	10	37	---	ND	Ui	ND	Ui	ND	U
Heptachlor	76-44-8	10	37	---	ND	U	ND	U	ND	U
Lindane	58-89-9	10	---	---	ND	U	ND	U	ND	Ui
A-1016	12674-11-12	---	---	---	ND	U	ND	U	ND	U
A-1221	11104-28-2	---	---	---	ND	U	ND	U	ND	U
A-1232	11141-16-5	---	---	---	ND	U	ND	U	ND	U
A-1242	53469-21-9	---	---	---	ND	U	ND	U	ND	U
A-1248	12672-29-6	---	---	---	ND	U	ND	U	ND	U
A-1254	11097-69-1	---	---	---	120		110		450	
A-1260	11096-82-5	---	---	---	84		86		180	
Total PCBs	1336-36-3	130	---	3100	**204**		**196**		**630**	
Total PCBs (mg/kg OC)	---	---	38	---	8.8		8.4		27.6	

(Notes on next page).

Notes:
Concentrations over regulatory limits are **bolded**.
ND = Not Detected
N = The Matrix Spike sample recovery is not within control limits.
B = The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL
D = The reported result is from a dilution
U = Undetected at detection limits
J = Result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
ǂ = 4-Methylphenol; this analyte cannot be separated from 3-Methylphenol
i = The MRL/MDL has been elevated due to a matrix interference.
P = The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results (25% for CLP pesticides)
[a] = Chemical Abstract Service Registry Number
[b] = Screening Level (Dry Wt.)
[c] = Bioaccumulation Trigger
[d] = Maximum Level (Dry Wt.)

Table 5. QA/QC Warning and Action Limits (DMMP Program).

	QA Element	Warning Limits	Action Limits
PRECISION	Metals	None	20% RPD or COV
	Organics	35% RPD or COV	50% COV or a factor of 2 for duplicates
MATRIX SPIKES	Metals	None	75-125% recovery
	Organics:[1] ▪ Volatiles ▪ Semivolatiles and Pesticides	 ▪ 70-150% ▪ 50-150%	None (however, zero percent recovery may be cause for data rejection)[2]
REFERENCE MATERIALS	Metals	None	95% CI if specified for a particular CRM; 80-120% recovery if not.
	Organics	None	95% CI for CRMs. No action limit for uncertified RMs.
SURROGATE SPIKES	Volatiles	85% minimum recovery	EPA CLP chemical-specific recovery limits
	Pesticides	60% minimum recovery	
	Semi-volatiles	50% minimum recovery	

Notes:
[1]For those chemicals covered under the CLP, warning limits are set at the CLP advisory limits for matrix spike duplicates.
[2]Rigorous control limits are not recommended due to possible matrix effects and interferences.

Table 6. Final bioassay summary table for GNW Cement Terminal, including results from amphipod retest.

STATION	% fines	% clay	Amphipod (*Eohaustorius*) Mortality (%) (from retest)		Sediment Larval (*Dendraster*) NCMA (%)		20-day *Neanthes* Growth: Survival (%)	Growth (mg/ind/day) 0.5 mg initial weight		Growth % of reference	DMMP	SL Exceedances
			mean	sd	mean	sd		mean	sd			
Control	-	-	5.0		0.0	2.6	100	1.20	0.17	110.1%	n/a	
Reference HH06-A	75.0	26.8	20.0	12.7	-	-	-	-	-	-	n/a	
Reference Carr Inlet	57.0	4.8	-	-	6.3	10.3	100	1.09	0.17	-	n/a	
S1	86.1	18.3	29.0	7.9	7.9	3.1	96	0.85	0.12	78.0%	pass	PCBs (240 ppb dry wt.; 8.8 ppm OC)
S2	90.9	21.1	*45.0*	6.7	6.0	4.6	100	*0.73*	0.13	67.0%	fail	PCBs (196 ppb dry wt.; 8.4 ppm OC)
S3	86.3	20.4	*50.0*	6.5	12.6	11.5	100	0.85	0.07	78.0%	pass	Sb, Zn, TBT, DDT, PCBs
Reference toxicant			$CdCl_2$ Data unusable		EC50; 10.5 µ/L Cu		$CdCl_2$ 96-hr LC50, 8.28 mg/L Cd					
Lab Control limits			n/a		8.97 – 13.2		3.69 – 10.9 mg/L Cd					

= good to go - no hits

= NO HIT - but significantly different than reference = NO HIT

= ONE-HIT - one hit, and significantly different than reference = ONE-HIT RULE

= *TWO-HIT* - significantly different than reference = TWO-HIT RULE

Table 7. DMMP Bioassay performance standards and evaluation guidelines.

Bioassay	Negative Control Performance Standard	Reference Sediment Performance Standard	Dispersive Disposal Site Interpretation Guidelines		Nondispersive Disposal Site Interpretation Guidelines	
			1-hit rule	2-hit rule	1-hit rule	2-hit rule
Amphipod	$M_C < 10\%$	$M_R - M_C < 20\%$	$M_T - M_C > 20\%$ and M_T vs. M_R SD (p=.05) And		$M_T - M_C > 20\%$ and M_T vs. M_R SD (p=.05) and	
			$M_T - M_R > 10\%$	NOCN	$M_T - M_R > 30\%$	NOCN
Larval (bivalve or echinoderm)	$N_C \div I > 0.70$	$N_R > N_C > 0.65$	$N_T \div N_C < 0.80$ and N_T/N_C vs. N_R/N_C SD (p=.10) and		$N_T \div N_C < 0.80$ and N_T/N_C vs. N_R/N_C SD (p=.10) and	
			$N_R/N_C - N_T/N_C > 0.15$	NOCN	$N_R/N_C - N_T/N_C > 0.30$	NOCN
Neanthes growth	$M_C < 10\%$ and $MIG_C > 0.38$	$M_R < 20\%$ and $MIG_R \div MIG_C > 0.80$	$MIG_T \div MIG_C < 0.80$ and MIG_T vs. MIG_R SD (p=.05) and		$MIG_T \div MIG_C < 0.80$ and MIG_T vs. MIG_R SD (p=.05) and	
			$MIG_T/MIG_R < 0.70$	NOCN	$MIG_T/MIG_R < 0.50$	$MIG_T/MIG_R < 0.70$

Notes:
M = mortality, N = normal survivors, I = initial count, MIG = mean individual growth rate (mg/individual/day)
SD = statistically different, NOCN = no other conditions necessary, N/A = not applicable
Subscripts: R = reference sediment, C = negative control, T = test sediment

Table 8. Glacier NW bioassay performance evaluation.

Bioassay	Test Sediment	Negative Control Performance Standard	Reference Sediment Performance Standard	Nondispersive Disposal Site Interpretation Guidelines	
				1-hit rule	*2-hit rule*
Amphipod (retest)	S-1	lab did not perform correctly; data unusable	15% ≤ 20% (mortality difference from control)	OK	OK
	S-2			OK	hit
	S-3			OK	hit
Sediment Larval	S-1	100% ≥ 70% (normal surviving larvae)	94% ≥ 65% (normal surviving larvae; % of control)	OK	OK
	S-2			OK	OK
	S-3			OK	OK
Neanthes growth	S-1	0% ≤ 10% (mortality) and 1.20 ≥ 0.38 (mean ind. growth rate, MIG)	0% ≤ 20% (mortality) and 91% ≥ 80% (MIG of ref. compared to control)	OK	OK
	S-2			OK	hit
	S-3			OK	OK

Table 9. Comparison of measured Z-sample concentrations with SMS criteria.

PARAMETER	SQS[a]	CSL[b]	DMMU 2-Z		DMMU 3-Z	
Conventional Parameters						
Total Solids (%)	---	---	57.5		74.8	
Total Organic Carbon (%)	---	---	2.47		---	
Metals (mg/kg-dry weight; ppm)						
Antimony	---		6.22	N	---	
Arsenic	57	93	**64.3**		---	
Cadmium	5.1	6.7	0.91		---	
Chromium	260	270	36.0	N	---	
Copper	390	390	164		---	
Lead	450	530	147		---	
Mercury	0.41	0.59	**0.60**		---	
Nickel	---	---	26.0		---	
Silver	6.1	6.1	0.9		---	
Zinc	410	960	351	N	---	
Organometallic Compounds (ug/L)						
Tributyltin (Interstertial Water)	---	---	---		**3.4**	D
Organics (mg/kg organic carbon)						
PCBs						
A-1016	---	---	4.2	U	---	
A-1221	---	---	4.2	U	---	
A-1232	---	---	4.2	U	---	
A-1242	---	---	4.2	U	---	
A-1248	---	---	4.2	U	---	
A-1254	---	---	4.2	U	---	
A-1260	---	---	4.2	U	---	
Total PCBs (mg/kg OC)	12	65	4.2	U	---	

[a] = Sediment Quality Standards
[b] = Cleanup Screening Level
U = Undetected at detection limits; MDL reported
N = The Matrix Spike sample recovery is not within control limits
D = The reported result is from a dilution
Notes:

- Bold values exceed SQS criteria
- Bold border denotes values that exceed CLS criteria
- There are no SQS criteria for TBT. However, the DMMP Screening Level/Bioaccumulation Trigger is 0.15 mg/L porewater. Because the reported value exceeds these standards, it is also bolded and bordered.

Concur:

4/10/03
Date

Lauran Cole Warner, Seattle District Corps of Engineers

4/10/03
Date

Erika Hoffman, Environmental Protection Agency

4/10/03
Date

Tom Gries, Washington Department of Ecology

4/10/2003
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Peter Leon, Washington Department of Natural Resources

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DMMO file